

these in the manner described, and some of them are reproduced in the accompanying photographs. It must be understood, of course, that these photographs are intended mainly as *diagrams*, to bring out the various patterns which are to be found in the arrangements of the star-groups. The successive copyings of the negative, and especially the interpolation of the guiding lines, have naturally injured the pictorial effect.

*Lick Observatory :*

1889 September 1.

The following photographs illustrating this paper are placed in the Library:—

- 1, 2. Milky Way, R.A.  $18^h 44^m$ , Decl. —  $6^\circ$  (Messier 11)
- 3, 4. Milky Way, R.A.  $17^h 56^m$ , Decl. —  $28^\circ$ .
5. Milky Way, R.A.  $18^h 11^m$ , Decl. —  $20^\circ$ .
- 6, 7. Nebula of Andromeda.

*Note on the Spectrum of the Sun-spot of June 1889.*

By the Rev. A. L. Cortie, S.J.

(Communicated by E. W. Maunder.)

In *Nature* of December 5, 1889, a list of bright lines is given which were observed by Professor Spörer, of Potsdam, on June 28, in a prominence that appeared as the large spot of that month was disappearing over the Sun's edge. The spectrum of this spot in the region D to B was observed at Stonyhurst on June 20, 22, 24, 26, and 27, the instrument used being the Browning automatic spectroscope, with a dispersion of twelve prisms of  $60^\circ$ . Of the seven lines measured by Professor Spörer in the same part of the spectrum of the prominence, excluding D<sub>1</sub>, D<sub>2</sub>, and C, four are due to calcium, the wave-lengths given being 672·6, 671·6, 649·2, and 646·2. Three other lines of calcium were observed between D and b, so that this element was very conspicuous in the prominence. In the spectrum of the spot all the lines given in Ångström's maps as due to calcium were seen to be widened; and of these the lines at 6492·41 and 6461·98, corresponding to Spörer's 649·2 and 646·2, were amongst the most widened lines in the spot, understanding by the term "most widened lines" those lines which were widened more than once their normal breadth. Four other calcium lines were also in this category, their wave-lengths being 6498·25, 6468·78, 6449·29, and 6438·35 respectively, and the widening of the rest was considerable, in no case being less than one-half the normal breadth of the line. Calcium was therefore also very conspicuous in the spectrum of the spot. On June 27 the line at 6492·41—one of the lines seen by Spörer the next day in the prominence—was widened no less than three times its normal breadth. On this day, when the spot was very near the edge of the Sun, several lines were seen to be displaced towards the violet end of the spectrum, among them being the iron lines, 6300·5, 6298·74, 6251·76, 6253·40, and particularly the calcium lines 6101·92 and 6121·34, although no displacement was noted in the calcium

lines seen bright in the prominence by Spörer the next day. It may be remembered that the line 6461.98 is common to the two elements calcium and iron. Besides the four calcium lines and the C line, Spörer also observed the D lines as bright in the prominence. In the spot the D lines were on the 20th nearly reversed, the lines being less dark where they crossed the spot; on the 22nd their widening was estimated as 0.2, while the C line was unaffected in the spot. On the 24th C was less dark over the spot, and  $D_1$  and  $D_2$  were widened 0.3. On the 26th  $D_1$  and  $D_2$  were less dark over the spot and displaced towards the more refrangible end of the spectrum. C was not observed. On the 27th  $D_1$  and  $D_2$  were widened 0.4 and displaced as before. As the spot was very near the Sun's limb, the field of view comprised not only the spot spectrum, but also the ordinary chromospheric lines. The bright line C was very much broadened at the solar limb. It could thence be traced as a bright band over the continuous spectrum right down to the penumbra of the spot. The band was on each side of the dark Fraunhofer line, and between 11 A.M. and noon was broader on the red than on the violet side of the line. The chromospheric line was also slightly displaced in the direction of the red. At 5.30 P.M., though the chromospheric line was not displaced, the bright band was broader on the violet than on the red side of the dark line. The dark line was itself unaffected in the spot, but was almost reversed on the following side of the spot, in all probability in the surrounding faculæ. In the following table are exhibited the results for all the calcium lines in this part of the spectrum:—

TABLE.  
*Calcium Lines in the Sun-spot of June 1889.*

Wave- Length.	Coin- cident Element.	June 20.	June 22.	June 24.	June 26.	June 27.	Prominence (Spörer) June 28.	Remarks.
6726.5	...	...	...	0.5	...	...	bright	
17.16	...	...	...	0.5	...	...	bright	
6498.25	...	1.0	1.0	...	...	...	...	
92.41	...	1.0	1.0	1.5	1.5	3.0	bright	
68.78	...	0.6	...	...	...	...	...	
61.98	Fe	2.0	0.8	1.0	1.0	1.0	bright	
49.29	Ba	2.0	0.8	1.0	1.0	1.0	...	
38.35	Cd	2.0	0.8	1.0	1.0	1.0	...	
6168.48	...	0.8	...	...	...	...	...	
61.40	...	0.6	...	...	...	...	...	
21.34	Co	0.7	...	...	...	0.8	...	{ 27th displaced to violet
01.92	Li	0.5	...	...	...	0.8	...	" "

*Note.*—Blanks in the above table do not mean that the line was not widened in the spot. The usual method of observation is first to note all the most widened lines between B and D, and then to observe every line in selected portions of the spectrum.

*Spectra of Southern Stars observed at the Melbourne Observatory with the McClean Direct-vision Spectroscope attached to the South Equatorial. Observer, P. Baracchi.*

II.

(Communicated by R. L. J. Ellery, F.R.S., Government Astronomer.)

No.	Star's Name	$\alpha$ 1890'o. h m s	N.P.D. 1890'o.	Description of Spectra and other Remarks.
1	$\epsilon$ Phenicis	0 3 49	136 21	Yellowish star. Spectrum with very fine dark lines, difficult to see.
2	$\iota$ Ceti	0 13 49	99 26	Yellowish star. Spectrum with extremely faint dark lines.
3	$\pi$ Toucani	0 15 35	160 14	Whitish star. Faint spectrum. Dark lines about F suspected.
4	$\beta$ Hydri	0 19 51	167 52	Yellowish star. Spectrum with fine dark lines.
5	$\kappa$ Phenicis	0 20 48	134 18	Whitish star. Spectrum with dark lines about F and G thick and conspicuous. Dark line about C suspected. Violet colour not seen.
6	$\alpha$ Phenicis	0 20 50	132 54	Yellowish star. Spectrum with very fine dark lines, difficult to see.
7	$\beta$ Toucani	0 26 29	153 34	White; double. Spectrum with dark lines about E, b, F, and G. G difficult. Violet hardly seen. E and b very faint. F thick and distinct.
8	Stone 194	0 27 43	153 38	White star. Spectrum with dark lines about F and G, thick and very distinct.
9	$\beta$ Ceti	0 38 4	108 35	Spectrum with dark lines about C, E, b, F, G, and other very faint ones. Yellowish star.
10	$\beta$ Phenicis	1 1 11	137 18	White star tending to yellow. Spectrum with dark lines about F and G, and others suspected. Violet not seen.
11	$\eta$ Ceti	1 3 3	100 46	White star. Spectrum with dark lines at F and G well seen. G very broad and diffused. Dark lines about C, E, and b suspected. Blue colour preponderates.
12	$\nu$ Phenicis	1 10 13	136 7	Whitish star. Spectrum with a broad, nebulous, dark band about G. Dark lines suspected. F pretty well seen. No violet.
13	$\theta$ Ceti	1 18 31	98 45	Yellowish star. Spectrum with very faint dark lines suspected.